PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-171216
(43)Date of publication of application : 23.06.2000

(51)Int.Cl. G01B 11/02
G01B 11/24

(21)Application number : 10-349575
(22)Date of filing : 09.12.1998

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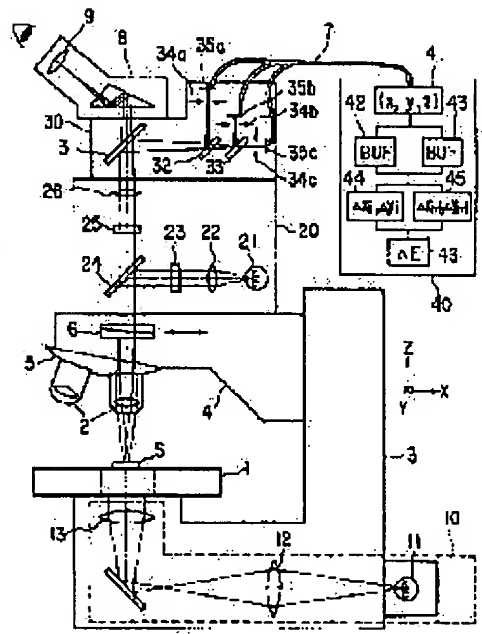
(54) SAMPLE MEASURING INSTRUMENT

(57)Abstract:
PROBLEM TO BE SOLVED: To provide the sample measuring instrument which can accurately measure the edges, outlines, shapes, sizes, etc., of various samples irrelevantly to the kinds of the samples such as whether they are transparent or opaque.



SOLUTION: This instrument is equipped with a transmission lighting system 10 which observes a sample S through transmission according to light transmitted through the sample, a vertical illumination system 20 which observes the sample in vertical illumination according to light reflected by the sample, a detection unit 30 which detects light from the sample, an arithmetic unit 40 which measures the sample by processing the detection signal from the detection unit as specified, and a birefringence element 6 which can selectively switch the vertical illumination observation and transmission observation and splits the vertical illumination light from the vertical illumination system into an ordinary light beam and an extraordinary light beam having mutually orthogonal vibration directions at the time of the vertical illumination observation. Here, when the vertical illumination observation is performed, the reflected light from the sample is converted by the detection unit 30 into an electric signal and the arithmetic unit 40 processes the electric signal as specified to calculate the chromaticity value of the reflected light and measures the sample according to the chromaticity value.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

Japanese Laid Open Patent No. 2000-171216
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CLAIMS

[Claim(s)]

[Claim 1] The transmitted illumination system for performing transparency observation to a sample based on the transmitted light which penetrated the sample, The epi-illumination system for performing incident light observation to a sample based on the reflected light reflected from the sample, By detecting the transmitted light or the reflected light from a sample, and performing predetermined data processing to the detecting signal outputted from the detection unit which outputs the detecting signal, and this detection unit While it is possible to switch alternatively the arithmetic unit which can measure a sample, and incident light observation and transparency observation When it has the observation system change element which can divide the epi-illumination light from an epi-illumination system into the ordinary ray an ordinary ray and the oscillating direction cross at right angles mutually, and an extraordinary ray at the time of incident light observation and is switched to the state in which incident light observation is possible by the observation system change element, The reflected light from a sample is a sample measuring device characterized by being changed into an electrical signal, computing the chromaticity value of the reflected light by an arithmetic unit performing predetermined data processing to the electrical signal, and measuring a sample based on the chromaticity value by the detection unit.

[Claim 2] It is the sample measuring device according to claim 1 characterized by for the transmitted light from a sample being changed into an electrical signal by the detection unit, computing quantity of light change of the transmitted light by an arithmetic unit performing predetermined data processing to the electrical signal when switched to the state in which transparency observation is possible by the aforementioned observation system change element, and measuring a sample based on the quantity of light change.

[Claim 3] It is the sample measuring device according to claim 1 characterized by for the

aforementioned arithmetic unit computing the color difference from the amount of chromaticity value changes in the state where it was switched to the state in which incident light observation is possible by the aforementioned observation system change element, and measuring a sample based on the variation of the color difference.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the sample measuring device for measuring the edge and profile of samples (for example, various parts of an industrial use product etc.), a configuration, a size, etc.

[0002]

[Description of the Prior Art] As this kind of a sample measuring device, as shown in drawing 2 , the edge-detection equipment equipped with the detection optical system with which the objective lens 201 was formed in the opposite side to the objective lens 201, the transmitted illumination system prepared in the position which counters, and X-Y stage 202 to X-Y stage 202 which can move in the direction which intersects perpendicularly to the optical axis of an objective lens 201, and this X-Y stage 202 is indicated by JP,5-99619,A.

[0003] The light source 203, the collector lens 204, and the condensing lens 205 are formed in the transmitted illumination system, and the image formation lens 206, the pinhole 207, and the light sensitive cell 208 are formed in detection optical system.

[0004] In such edge-detection equipment, once carrying out image formation of the light emitted from the light source 203 to the anterior focal position 209 of a condensing lens 205 with the collector lens 204, it is changed into the parallel flux of light by the condensing lens 205, and carries out Koehler illumination of the sample 210, i.e., analyte, of non-transparence set to X-Y stage 202.

[0005] The diffracted light generated from the analyte 210 projects the expansion image of an analyte 210 into the 207th page of a pinhole with the image formation lens 206, after being incorporated with an objective lens 201. And incidence of the flux of light which passed the pinhole 207 is carried out to the light sensitive cell 208 in back. At this time, the quantity of light which carries out incidence to a light sensitive cell 208 because the image of an analyte 210 crosses a pinhole 207 changes, and the output changes.

[0006] The output of a light sensitive cell 208 changes according to the position of an analyte 210. The relation between the position of an analyte 210 and the output of a light sensitive cell is shown in drawing 3 (A), the position of an analyte 210 makes

positive the direction where an analyte 210 moves to right and left in drawing 2 , and the output of a light sensitive cell 208 is standardized to "1."

[0007] When all the images of an analyte 210 are applied to a pinhole 207 by the output of a light sensitive cell 208 decreasing gradually as the output of a light sensitive cell 208 is "1" and the image of an analyte 210 is applied to a pinhole 207, when having not applied the image of an analyte 210 to a pinhole 207 at all, the output of a light sensitive cell 208 is set to "0."

[0008] As especially shown in drawing 3 (B), when image 210a of an analyte 210 cuts in a half exactly at a pinhole 207, it is thought that the output of a light sensitive cell 208 is set to "0.5" (refer to this drawing (A)).

[0009] With the edge-detection equipment mentioned above, while moving an analyte 210 and going, the position where the output of a light sensitive cell 208 became "0.5" is judged as an edge of an analyte 210. And an appearance, a bore diameter, etc. of an analyte 210 are measured by judging combining the position which detected the edge of an analyte 210, and the movement magnitude of X-Y stage 202.

[0010] Moreover, the position detection equipment which has composition as shown in drawing 4 is indicated by JP,7-239212,A as other conventional technology.

[0011] In this position detection equipment, after carrying out incidence of the lighting light 411 emitted from the light source 401 to a polarizer 403 through a capacitor 402, only the linearly polarized light of a certain arbitrary directions is extracted. It separates into two polarization inspection light 411a and 411b which the plane of polarization intersected perpendicularly mutually, and carried out horizontal gap only of the minute amount by Wollaston prism 405, and the extracted linearly polarized light is irradiated by the sample 412 through an objective lens 406, after being reflected from a beam splitter 404.

[0012] After it is incorporated with an objective lens 406 and the two aforementioned polarization inspection light 411a and 411b is compounded by Wollaston prism 405 at the same optical path, the reflected light reflected from the sample 412 penetrates a beam splitter 404, and it carries out incidence to an analyzer 407. At this time, the two aforementioned polarization inspection light 411a and 411b which penetrates an analyzer 407 is set to polarization interference light 411c which the polarization components interfere, consequently has the phase contrast according to the rate of the irregularity of a sample 412 based on the optical property of an analyzer 407. And image formation of this polarization interference light 411c is carried out to light-receiving side 409a of a photodetector 409 as an image of an irradiation position with the image formation lens 408.

[0013] As a property of the image of the irradiation position which carried out image formation to this light-receiving side 409a, the polarization interference intensity is "0", and since a detecting signal is not outputted, the image of the flat-surface section of a

sample 412 is dark. On the other hand, image formation of the image of the concavo-convex section of a sample 412 is carried out as a bright line with predetermined intensity, and the detecting signal according to it is outputted. After the outputted detecting signal is changed into the electrical signal according to the optical intensity distribution of polarization interference light 411c, it is sent to the signal-processing means 410, and the edge (level difference) of the concavo-convex section of a sample 412 is detected.

[0014] How to search for the on-the-strength peak of the detected signal as the edge-detection method, for example, and to judge the position corresponding to this peak to be an edge, or the method of with a function with a suitable secondary function etc. and judging the peak center of the function [fitting / function] to be an edge / near the on-the-strength peak /, -- or After defining a specific threshold, there is a method of asking for the position where an on-the-strength value exceeds a threshold in right and left of an on-the-strength peak, and judging one position of the called-for positions or both centers to be edges etc.

[0015]

[Problem(s) to be Solved by the Invention] However, since transmitted illumination is being used for the edge-detection equipment indicated by JP,5-99619,A, it can perform only measurement of the configuration of the profile of an analyte, or a size. For example, configuration measurement or size measurement of the projection in the hole or hollow which have not been penetrated cannot be performed. Furthermore, since the edge of an analyte 210 etc. is measured based on the intensity of the quantity of light obtained by the light sensitive cell 208 of detection optical system, when nonuniformity etc. is in the reflection factor of an analyte 210, it will become difficult to change measured value and to measure an edge etc. correctly by the nonuniformity etc.

[0016] On the other hand, since the position detection equipment indicated by JP,7-239212,A has detected the edge (level difference) based on the intensity of the quantity of light obtained with the photodetector 409 as well as the edge-detection equipment indicated by JP,5-99619,A, it is tended to influence the detection value the nonuniformity of the reflection factor of a sample 412 etc. Furthermore, the position (position which phase contrast does not generate) used as the criteria on a sample 412 is changed into a dark state, and since the edge (level difference) is detected based on the luminous intensity produced by the light and darkness, in order to complete a dark state as a measurement setup, you have to adjust the amount of retardations. In measurement of the sample which has specification in the configuration represented by the wafer etc. in this case, a sample with fixed thickness, etc. The sample from which a configuration differs separately like common hardware parts, for example although the aforementioned retardation adjustment can be managed with 1 time of initial setting, In order that dispersion in thickness may perform the aforementioned retardation

adjustment for every measurement to each sample by the comparatively large sample compared with dimensional accuracies, such as a wafer, a measurement setup will take time, consequently measurement efficiency will fall.

[0017] this invention is accomplished in order to solve such a problem, and the purpose does not ask the kind of samples, such as transparence and opacity, but is to offer the sample measuring device which can measure correctly various edges and profiles of a sample, a configuration, a size, etc.

[0018]

[Means for Solving the Problem] In order to attain such a purpose, the sample measuring device of this invention The transmitted illumination system for performing transparency observation to a sample based on the transmitted light which penetrated the sample, The epi-illumination system for performing incident light observation to a sample based on the reflected light reflected from the sample, By detecting the transmitted light or the reflected light from a sample, and performing predetermined data processing to the detecting signal outputted from the detection unit which outputs the detecting signal, and this detection unit While it is possible to switch alternatively the arithmetic unit which can measure a sample, and incident light observation and transparency observation When it has the observation system change element which can divide the epi-illumination light from an epi-illumination system into the ordinary ray an ordinary ray and the oscillating direction cross at right angles mutually, and an extraordinary ray at the time of incident light observation and is switched to the state in which incident light observation is possible by the observation system change element, By the detection unit, the reflected light from a sample is changed into an electrical signal, computes the chromaticity value of the reflected light by an arithmetic unit performing predetermined data processing to the electrical signal, and measures a sample based on the chromaticity value.

[0019]

[Embodiments of the Invention] Hereafter, the sample measuring device concerning the gestalt of 1 operation of this invention is explained with reference to drawing 1 .

[0020] As shown in drawing 1 , the sample measuring device of the gestalt of this operation is equipped with the sample maintenance stage 1 which can arrange the sample S of transparence or non-transparence alternatively, and the revolver 5 of the rotating type which can two or more attach the objective lens 2 of a different scale factor is formed in the upper part side of this sample maintenance stage 1 so that Sample S can be observed for a desired scale factor.

[0021] The sample maintenance stage 1 is supported by the mirror machine 3 which this sample maintenance stage 1 has the function to read the movement magnitude with high precision, by being constituted so that it can move along the perpendicular biaxial (X-axis, Y-axis) direction to the direction of an optical axis (Z-axis) of an objective

lens 2, and has firm rigidity.

[0022] The arm section 4 which has the function for movement in the direction of an optical axis (Z-axis) of an objective lens 2 to be possible, and to read the movement magnitude with high precision is formed in the mirror machine 3, and the revolver 5 mentioned above is supported at the sample maintenance stage 1 side of this arm section 4. In this case, the focal position of the objective lens 2 to Sample S can be adjusted by moving the arm section 4 in the direction of an optical axis (Z-axis).

[0023] The transmitted illumination system 10 for performing transparency observation to Sample S in such a sample measuring device based on the transmitted light which penetrated Sample S, The epi-illumination system 20 for performing incident light observation to Sample S based on the reflected light reflected from Sample S, By detecting the transmitted light or the reflected light from Sample S, and performing predetermined data processing to the detecting signal outputted from the detection unit 30 which outputs the detecting signal, and this detection unit 30 The arithmetic unit 40 which can measure the edge and profile of Sample S, a configuration, a size, etc. is formed.

[0024] The transmitted illumination system 10 is formed in the mirror machine 3 by the side of the lower part of the sample maintenance stage 1, and consists of the light source 11 for transparency observation for performing transparency observation, a collector lens 12, and a condensing lens 13. In this transmitted illumination system 10, once image formation of the transmitted illumination light from the light source 11 for transparency observation is carried out to the anterior focal position of a condensing lens 13 with the collector lens 12, it carries out Koehler illumination of the sample S by the condensing lens 13.

[0025] The epi-illumination system 20 is formed in the upper surface side (the field where the revolver 5 is arranged is a field of an opposite side) of the arm section 4. The light source 21 for incident light observation for this epi-illumination system 20 performing incident light observation, The collimate lens 22 which makes parallel light epi-illumination light from this light source 21 for incident light observation, The polarizer 23 which can take out the linearly polarized light of arbitrary directions from the epi-illumination light emitted from the light source 21 for incident light observation, The optical-path bending element 24 represented by the one-way mirror for making in agreement the optical axis of an objective lens 2, and the optical axis of the epi-illumination system 20 etc., It consists of an analyzer 25 arranged so that an objective lens 2 may be countered on both sides of this optical-path bending element 24 and a polarizer 23 and a crossed Nicol may be satisfied, and an image formation lens 26.

[0026] In the optical path between an objective lens 2 and the image formation lens 26, the birefringence element 6 represented by the Nomarski prism positioned so that 45 degrees of crystallographics axis might incline to the polarization direction obtained

with the polarizer 23 is arranged. The birefringence element 6 is constituted possible [movement in the direction of the arrow in drawing] in between the position in the optical path between an objective lens 2 and the image formation lens 26, and the positions from which it separated from this optical path, and can switch now incident light observation and transparency observation alternatively by inserting [element / birefringence / 6 / this] to an optical path.

[0027] That is, this birefringence element 6 functions as an observation system change element which switches incident light observation and transparency observation alternatively. Specifically, when the birefringence element 6 is positioned into an optical path, it will be in a state incident light observable [to Sample S], and it will become possible to carry out normal skiing lighting of the sample S with the combination of the light source 21 for incident light observation, a collimate lens 22, the birefringence element 6, and an objective lens 2. On the other hand, when the birefringence element 6 is removed from an optical path, it will be in a state transparency observable [to Sample S].

[0028] The optical-path division element 31 represented by the one-way mirror for the detection unit 30 branching the light from Sample S to an observation optical path and the detection optical path mentioned later etc., The 1st wavelength-selection element 32 which reflects the light more than a red wavelength region, and penetrates the light below a green wavelength region, It has the 2nd wavelength-selection element 33 which reflects the light more than a green wavelength region, and penetrates the light below a blue wavelength region. In the posterior focal position of the objective lens 2 on each optical path which branched by these [1st] and the 2nd wavelength-selection element 32 and 33, and a conjugate position While specifying a sample measurement field, the pinholes 34a, 34b, and 34c for omitting the information used as the noise from the focal position order side of an objective lens 2 are arranged. Furthermore, the light which passed these pinholes 34a, 34b, and 34c is received to the detection unit 30, the detectors 35a, 35b, and 35c which can output the electrical signal according to the light income (light-receiving intensity) are formed in it, and each pinholes 34a, 34b, and 34c are positioned so that the center may be made in agreement with the optical axis of an objective lens 2.

[0029] It connects with the detection unit 30 electrically through the cable 7, and the arithmetic unit 40 is equipped with the arithmetic circuit 41 which consisted of storages 42-45 and a difference circuit 46. In this arithmetic unit 40, the edge and profile of Sample S, a configuration, a size, etc. can be measured now by performing various data processing to the electrical signal outputted from each detectors 35a, 35b, and 35c.

[0030] In addition, the ocular 9 for performing picture observation using two-dimensional photo detectors, such as visual observation or a CCD camera, is formed in the lens-barrel 8, and this lens-barrel 8 is connected to the detection unit 30 so that

the optical axis of an objective lens 2 and an ocular 9 may be made in agreement.

[0031] Next, operation of a sample measuring device is explained.

[0032] First, the birefringence element 6 is arranged in the optical path between an objective lens 2 and the image formation lens 26, and operation which performs incident light observation to Sample S is explained.

[0033] After it is made parallel light through a collimate lens 22 and only the linearly polarized light component of arbitrary directions is extracted by the polarizer 23, by the optical-path bending element 24, an optical path is bent 90 degrees and carries out incidence of the epi-illumination light emitted from the light source 21 for incident light observation to the birefringence element 6. The epi-illumination light of the linearly polarized light component which carried out incidence to the birefringence element 6 is divided into the ordinary ray and extraordinary ray an extraordinary ray and the oscillating direction cross at right angles mutually by this birefringence element 6. And these ordinary rays and an extraordinary ray carry out normal skiing lighting of the sample S, after projecting the filament image of the two light sources 21 for incident light observation which shifted to the pupil position of an objective lens 2 a little [fine] according to the amount of share rings of the birefringence element 6.

[0034] After the reflected light from Sample S is incorporated with an objective lens 2, it is compounded on the same optical path in the birefringence element 6. When an edge (level difference) is in the sample S in **** at this time, in a place with an edge (level difference), the phase contrast according to the rate arises. After the reflected light compounded on the same optical path with the birefringence element 6 penetrates the optical-path bending element 24, with a part for usual state Mitsunari, and an unusual light component maintained, in an analyzer 25, only the component which penetrates an analyzer 25 among a part for usual state Mitsunari and an unusual light component interferes in it mutually.

[0035] After this interference light penetrates the image formation lens 26, the light guide of some of the interference lights is carried out by the optical-path division element 31 to the lens-barrel 8 for performing viewing or picture observation, and the light guide of the remaining interference lights is carried out to the detection optical path in the detection unit 30. With an ocular 9, on an observer's retina, the interference light by which the light guide was carried out to the lens-barrel 8 serves as a sample image, and image formation is carried out, and it can perform visual observation of Sample S based on this sample image. On the other hand, incidence of the interference light by which the light guide was carried out to the detection optical path is carried out to the 1st wavelength-selection element 32 which reflects the light more than a red wavelength region, and penetrates the light below a green wavelength region first.

[0036] The interference light of the red wavelength reflected from the 1st wavelength-selection element 32 is transmitted to an arithmetic unit 40 through a cable

7, after passing pinhole 34a, and light's being received by detector 35a and changing into the electrical signal (Rsig) according to the light income (light-receiving intensity) only the reflected light component reflected by the focal plane of an objective lens 2.

[0037] the interference light below the green wavelength region which, on the other hand, penetrated the 1st wavelength-selection element 32 -- next, incidence is carried out to the 2nd wavelength-selection element 33 which reflects the light more than a green wavelength region, and penetrates the light below a blue wavelength region

[0038] The interference light of the green wavelength reflected from the 2nd wavelength-selection element 33 is transmitted to an arithmetic unit 40 through a cable 7, after passing pinhole 34b, and light's being received by detector 35b and changing into the electrical signal (Gsig) according to the light income (light-receiving intensity) only the reflected light component reflected by the focal plane of an objective lens 2.

[0039] On the other hand, the interference light of the blue wavelength which penetrated the 2nd wavelength-selection element 33 is transmitted to an arithmetic unit 40 through a cable 7, after passing pinhole 34c, and light's being received by detector 35c and changing into the electrical signal (Bsig) according to the light income (light-receiving intensity) only the reflected light component reflected by the focal plane of an objective lens 2.

[0040] Thus, as for the electrical signal transmitted in detail, predetermined data processing is performed in the arithmetic circuit 41 of an arithmetic unit 40. Specifically, XY chromaticity value (xi and yi) is computed. XY chromaticity value can specify the value for which it does not depend on brightness from XY chromaticity diagram which evaluates all colors only depending on a hue and saturation, and can calculate this XY chromaticity value by the following (1) formulas and (2) formulas.

[0041]

[Equation 1]

[0042] Hereafter, data processing of an arithmetic unit 40 is explained concretely.

[0043] Here, if XY chromaticity value computed by having transmitted the electrical signal (Rsig1, Gsig1, and Bsig1), and carrying out data processing of this electrical signal first based on the above-mentioned (1) formula and (2) formulas is set to (x1 and Y1), this XY chromaticity value (x1 and Y1) will be memorized by the 1st storage 42. And XY chromaticity value (x2 and y2) computed from the electrical signal (Rsig2, Gsig2, and Bsig2) transmitted to the degree is memorized by the 2nd storage 43. then, the difference (deltax12=x2-x1 and deltay12=y2-y1) of each chromaticity value memorized by the 1st and 2nd storages 42 and 43 computes -- having -- the value -- the 1st difference -- a storage 44 memorizes

[0044] Moreover, XY chromaticity value (x3 and y3) computed from the electrical signal

(Rsig3, Gsig3, and Bsig3) transmitted to the degree furthermore, after the 1st storage 42 memorizes, the difference (deltax23=x3-x2 and deltay23=y3-y2) of each chromaticity value memorized by the 1st and 2nd storages 42 and 43 computes -- having -- the value -- the 2nd difference -- a storage 45 memorizes And in a difference circuit 46, color difference deltaE {=(deltax23-deltax12)2+(deltay23-deltay12) 2} is drawn.

[0045] Such data processing is always repeated, and when Sample S is being moved, only the moment an edge (level difference) passes the measurement spot decided by each scale factor of the size of Pinholes 34a, 34b, and 34c, an objective lens 2, and the image formation lens 26, it is set to color difference deltaE>0. However, it is set to color difference deltaE=0 when there is no edge (level difference) during the case where the sample S on the sample maintenance stage 1 is moved, and there is nothing, or movement.

[0046] Therefore, the distance to the point set to the following color difference deltaE>0 from the point used as color difference deltaE>0 serves as an edge on Sample S (level difference), and an interval of a profile.

[0047] While transparence, and the edge (level difference) and profile of the opaque sample S are correctly detectable by having used epi-illumination light according to the incident light observation to the sample S which was mentioned above It becomes possible to measure correctly configurations other than an edge (level difference) or a profile, for example, the configuration of a projection where it is buried in the configuration and profile of the hole which has not been penetrated (in a hollow), and the size of those. Moreover, it becomes possible to measure Sample S correctly, without being influenced by output change of the light source 21 for incident light observation, and change of the reflection factor of Sample S by having used XY chromaticity value which cannot be easily influenced by change of the quantity of light. Furthermore, since needed "setup of a threshold" becomes unnecessary when measuring Sample S based on change of the quantity of light, the working efficiency in sample measurement can be raised.

[0048] Next, the birefringence element 6 is removed out of the optical path between an objective lens 2 and the image formation lens 26, and operation which performs transparency observation to Sample S is explained.

[0049] Once carrying out image formation of the light emitted from the light source 11 for transparency observation to the anterior focal position of a condensing lens 13 with the collector lens 12, it is changed into the parallel flux of light by the condensing lens 13, and carries out Koehler illumination of the sample S set to the sample maintenance stage 1.

[0050] The transmitted light which penetrated Sample S penetrates an analyzer 25 from the optical-path bending element 24, after being incorporated with an objective lens 2, further, after it penetrates the image formation lens 26, the light guide of a part

of the transmitted lights is carried out by the optical-path division element 31 to the lens-barrel 8 for performing viewing or picture observation, and the light guide of it is carried out to the detection optical path which the remaining transmitted lights mentioned above. The transmitted light by which the light guide was carried out serves as a sample image on an observer's retina with an ocular 9 to a lens-barrel 8, image formation is carried out to it, and visual observation of Sample S can be performed based on this sample image. On the other hand, the transmitted light by which the light guide was carried out to the detection optical path projects the expansion image of Sample S with the image formation lens 26 into each pinholes 34a and 34b, and 34 c-th page. And incidence of the flux of light which passed these pinholes 34a, 34b, and 34c is carried out to each light sensitive cell 35a, 35b, and 35c. At this time, from each light sensitive cell 35a, 35b, and 35c, the electrical signal according to light income is outputted, and it is transmitted to an arithmetic unit 40 through a cable 7.

[0051] In an arithmetic unit 40, predetermined data processing is performed to the electrical signal from light sensitive cells 35a, 35b, and 35c. As the example, an arithmetic circuit 41 totals the electrical signal from light sensitive cells 35a, 35b, and 35c, and assumes the case where predetermined data processing is performed to the total electrical signal. In this case, the quantity of light which carries out incidence to each light sensitive cell 35a, 35b, and 35c because the image of Sample S crosses Pinholes 34a, 34b, and 34c changes, and the output changes. Since the output of the total electrical signal also changes at this time, an edge (level difference), a profile, etc. of Sample S can be measured by detecting the change. For example, what is necessary is just to judge as an edge (level difference), a profile, etc. of Sample S, when the maximum and the minimum value of change of the total electrical signal are detected and the middle value is detected.

[0052] It is possible to judge as an edge (level difference), a profile, etc. of Sample S by the method of detecting change of the electrical signal outputted from one light-sensitive-cell 35a in this case as well as the above.

[0053] In addition, in the gestalt of operation mentioned above, a revolver 5 is not necessarily required and omitting according to a use is also possible. At this time, it is effective in the ability of the whole equipment to provide cheaply.

[0054] Moreover, the arm section 4 and the epi-illumination system 20 do not necessarily need to be another objects. At this time, it is effective in the ability to suppress ** which can perform lightweight-ization of the whole equipment, and the factor from which an optical axis shifts to the minimum.

[0055] Furthermore, in order to omit the information used as the noise from the focal position order side of an objective lens 2, it is not necessary to be necessarily Pinholes 34a, 34b, and 34c, and you may use a variable aperture. Since it can carry out adjustable [of the size of drawing], the sensitivity of an edge detection can choose freely

and the effect of measurement efficiency going up is born by what is fine like for example, common hardware parts at this time, and pulls, and an eye generates.

[0056] this invention can deform variously within limits which do not deviate from the main point of this invention, without being limited to the gestalt of operation mentioned above.

[0057] for example, the pinholes 34a, 34b, and 34c arranged in the posterior focal position of an objective lens 2, and the conjugate position -- the size of the optical passage path -- arbitrary -- **** -- it is desirable that last thing constitutes to do It is because incorrect detection can decrease and detection precision can be raised by enlarging the size of an optical passage path, even if the field of Sample S is a detailed irregularity-like split face and it is in the field state of Sample S where it will be considered that all are edges (level difference).

[0058] In addition, the purpose can be attained, if an example is taken by the main point of the invention in this application and it has the epi-illumination system.

[0059] That is, the epi-illumination system for the sample measuring device of the invention in this application performing incident light observation to a sample based on the reflected light reflected from the sample, By detecting the reflected light from a sample and performing predetermined data processing to the detecting signal outputted from the detection unit which outputs the detecting signal, and this detection unit It has the optical element which can divide the arithmetic unit which can measure a sample, and the epi-illumination light from an epi-illumination system into the ordinary ray an ordinary ray and the oscillating direction cross at right angles mutually, and an extraordinary ray. The reflected light from a sample is detected in a detection unit through an optical element, and is changed into an electrical signal by this detection unit. an arithmetic unit Predetermined data processing is performed to the electrical signal, and the chromaticity value of the reflected light is calculated, and based on the chromaticity value, it may be constituted so that a sample may be measured.

[0060] Moreover, also in this composition, by constituting so that it can carry out adjustable [of the size of the optical passage path] arbitrarily, and constituting in this way, incorrect detection can decrease as above-mentioned and the above-mentioned pinholes 34a, 34b, and 34c can raise detection precision.

[0061]

[Effect of the Invention] According to this invention, the kind of samples, such as transparence and opacity, is not asked, but it is in offering the sample measuring device which can measure correctly various edges and profiles of a sample, a configuration, a size, etc.